Microwave Fuze

INNOVATIVE DIGITAL PROXIMITY FUZE FOR 76/62 mm GUN (Microwave, Programmable)

Otobreda Division

Alenia DIFESA

Companies

SIMMEL DIFESA

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45th Fuze Conference, Long Beach, CA, April 16-18 2001

Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
17Apr2001	N/A	-

Title and Subtitle INNOVATIVE DIGITAL PROXIMITY FUZE FOR 76/62 mm GUN (Microwave, Programmable)	**Contract Number**
	Grant Number
	Program Element Number
Author(s) Carriero, Antonio; Brogi, Marco; Caleo Maurizio	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) Alenia Companies	**Performing Organization Report Number**
Sponsoring/Monitoring Agency Name(s) and Address(es) NDIA (National Defense Industrial Assocation) 211 Wilson BLvd., Ste. 400 Arlington, VA 22201-3061	**Sponsor/Monitor's Acronym(s)**
	Sponsor/Monitor's Report Number(s)

Distribution/Availability Statement
Approved for public release, distribution unlimited

Supplementary Notes
Proceedings from The 45th Annual Fuze Conference, 16-18 April 2001 Sponsored by NDIA, The original document contains color images.

Abstract

Subject Terms

Report Classification unclassified	**Classification of this page** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** UU

Number of Pages
23

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ITALIAN NAVY

awarded the development contract

ALENIA DIFESA
OTOBREDA DIV.

(former OTO Melara)

- computer modeling
- μW sensor
- signal processor
- firing tests

SIMMEL DIFESA SpA

(heritage from Borletti and BPD)

- fuze integration
- impact sensor
- post-impact delay
- battery
- S&A
- pyrotechnic chain

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FUZE MAJOR FEATURES

- PROGRAMMABILITY OF OPERATING MODES from the FCS through a setter
- 5 OPERATING MODES
  - PROXIMITY vs SEA SKIMMER (default mode)
  - PROXIMITY vs FIXED WING AIRCRAFT
  - PROXIMITY vs ROTARY WING AIRCRAFT
  - PROXIMITY vs SURFACE TARGETS
  - DELAYED IMPACT vs REINFORCED TARGETS
- 2 BACK-UP MODES (not available if delayed impact is selected)
  - UNDELAYED IMPACT
  - SELF DESTRUCTION

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FUZE MAJOR FEATURES
continued

- SAFETY SYSTEM
  - COMPLIANT WITH STANAG 4187
  - SAFE SEPARATION DISTANCE (MECHANICAL ARMING) > 100 m
- OPERATING TEMPERATURE RANGE –31°C ÷ +63°C
- STORAGE TEMPERATURE RANGE –40°C ÷ +71°C

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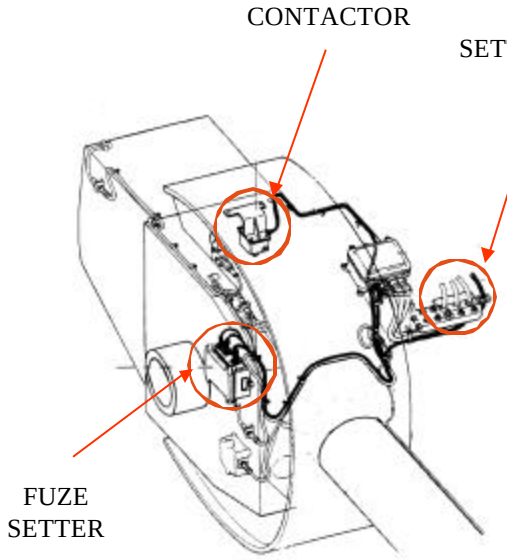
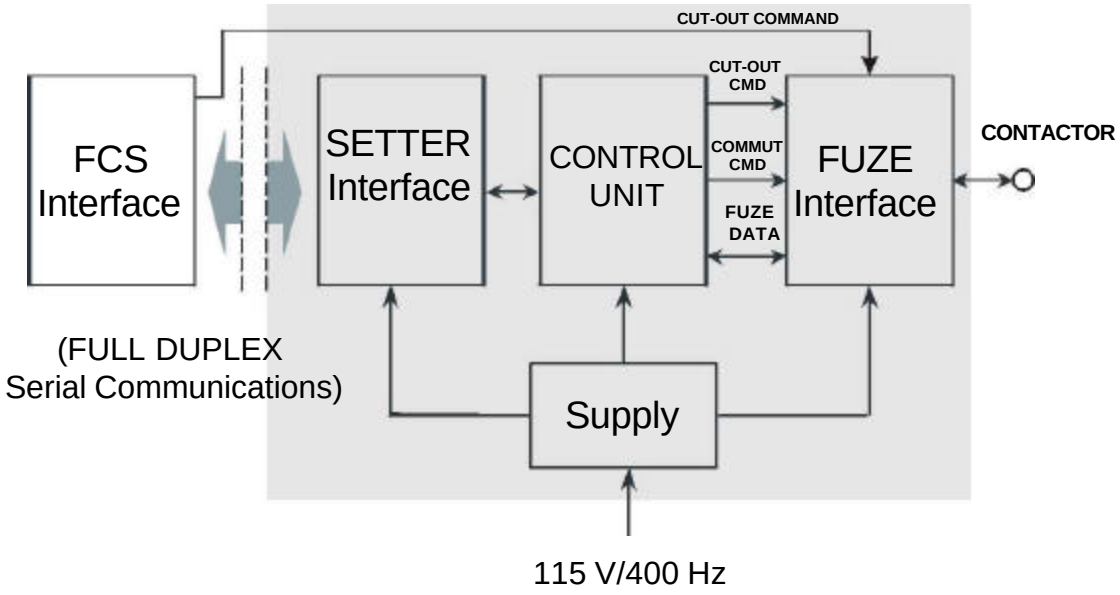
ELECTRONIC SETTING SYSTEM FOR 76 mm PROXIMITY FUZE



INSTALLATION ON GUN ELEVATING MASS

FUNCTIONAL BLOCK DIAGRAM



(FULL DUPLEX
Serial Communications)

115 V/400 Hz

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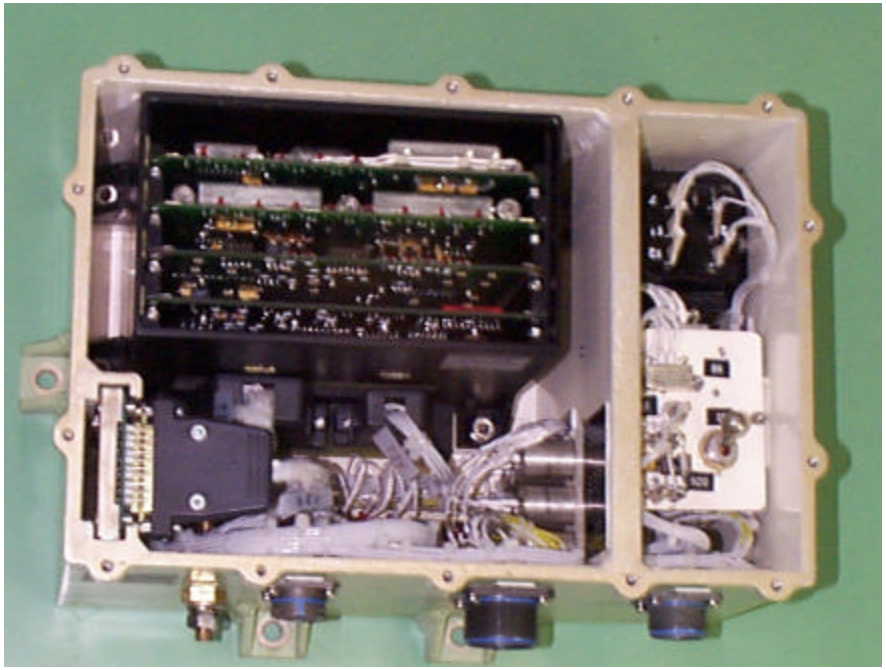
ELECTRONIC SETTER FOR 76 mm PROXIMITY FUZE



- DEVELOPMENT COMPLETED
- 4 SYSTEMS ORDERED BY ITALIAN NAVY FOR NEW FPB's
- 18 SYSTEMS WILL BE INSTALLED ON EXISTING SHIPS

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ELECTRONIC SETTER FOR 76 mm PROXIMITY FUZE

FUNCTIONS

- SELECT THE OPERATING MODE (PROXIMITY/DELAYED IMPACT).
- ENABLE FUZE RECEIVER JUST BEFORE TARGET INTERCEPT.
- OPTIMIZE PROXIMITY PERFORMANCE AGAINST DIFFERENT KINDS OF TARGETS BY SELECTING DEDICATED SOFTWARE.
- RETAIN THE COMPATIBILITY WITH IN-SERVICE FUZES

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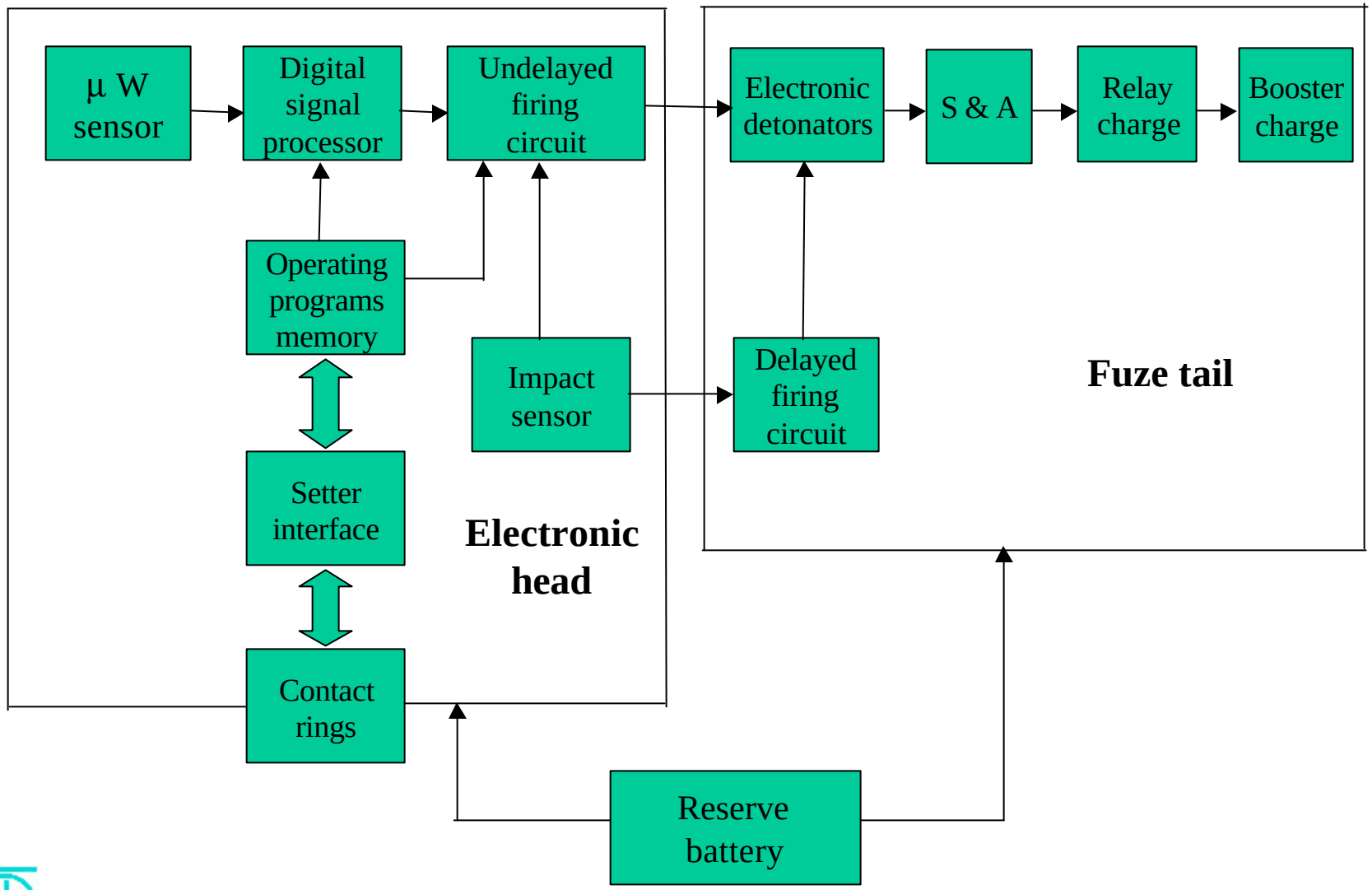

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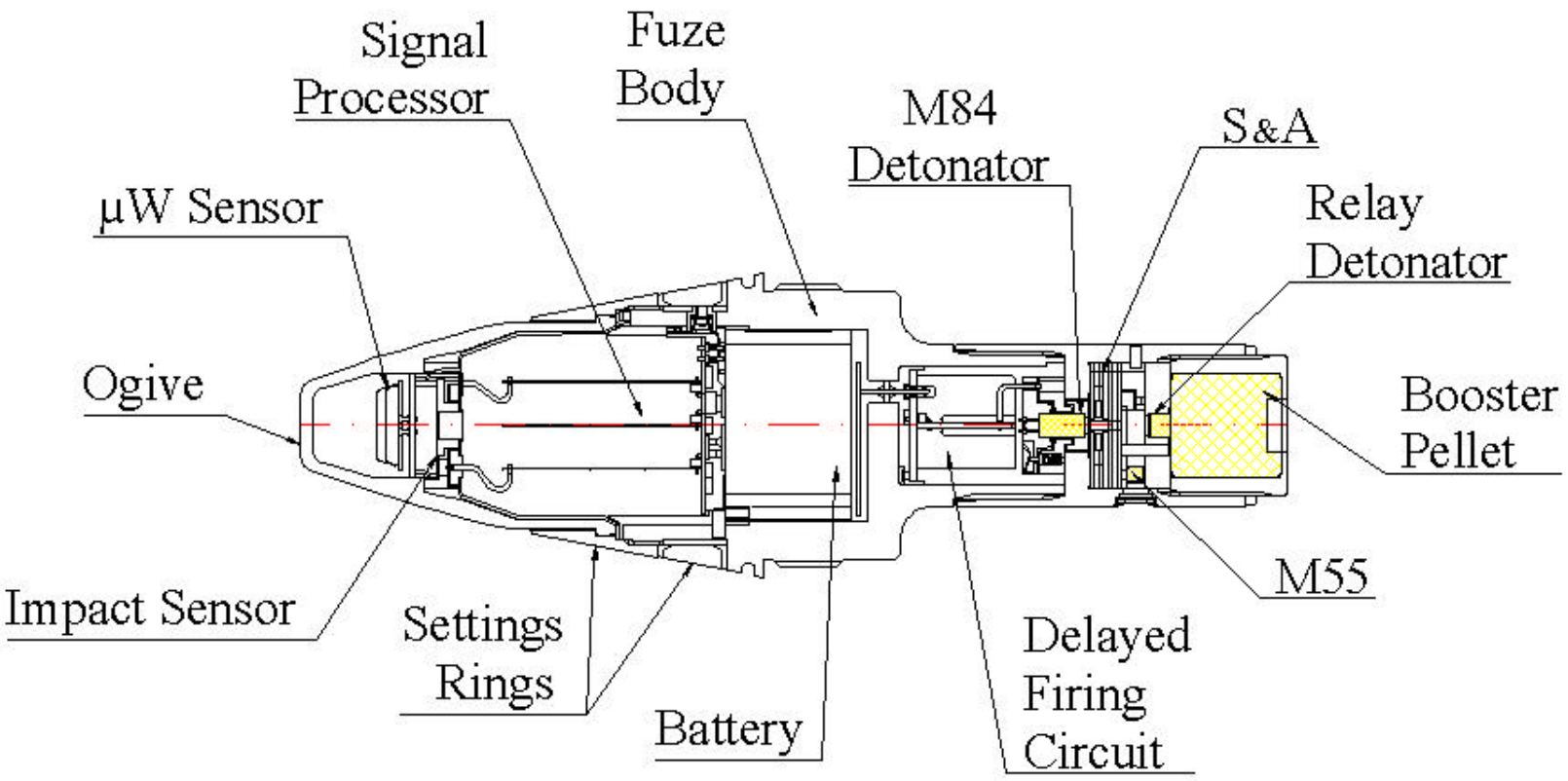
Fuze layout



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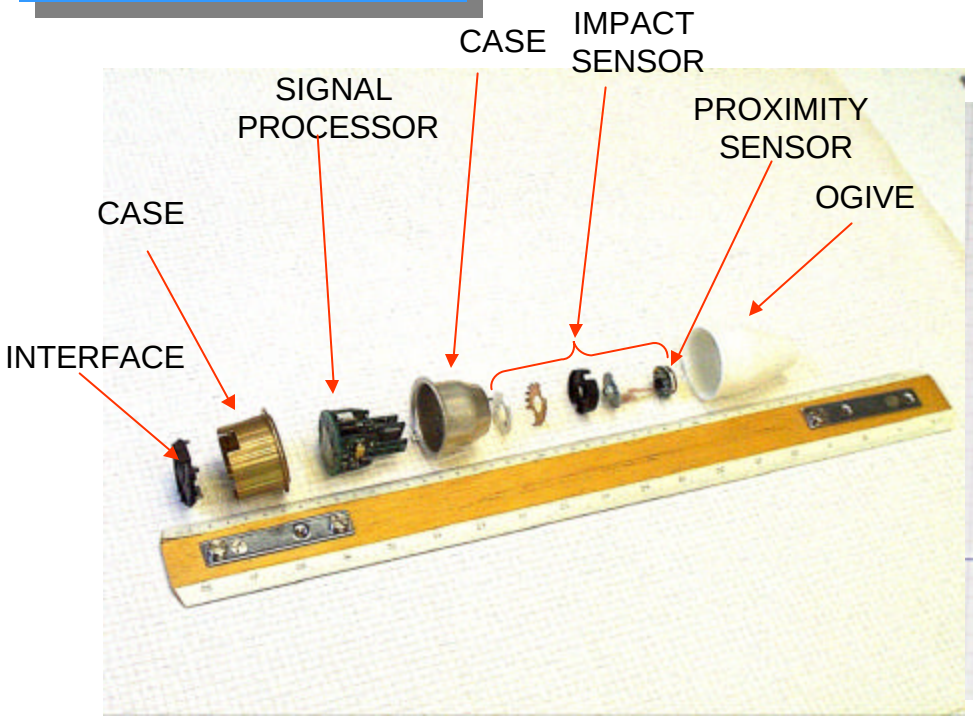
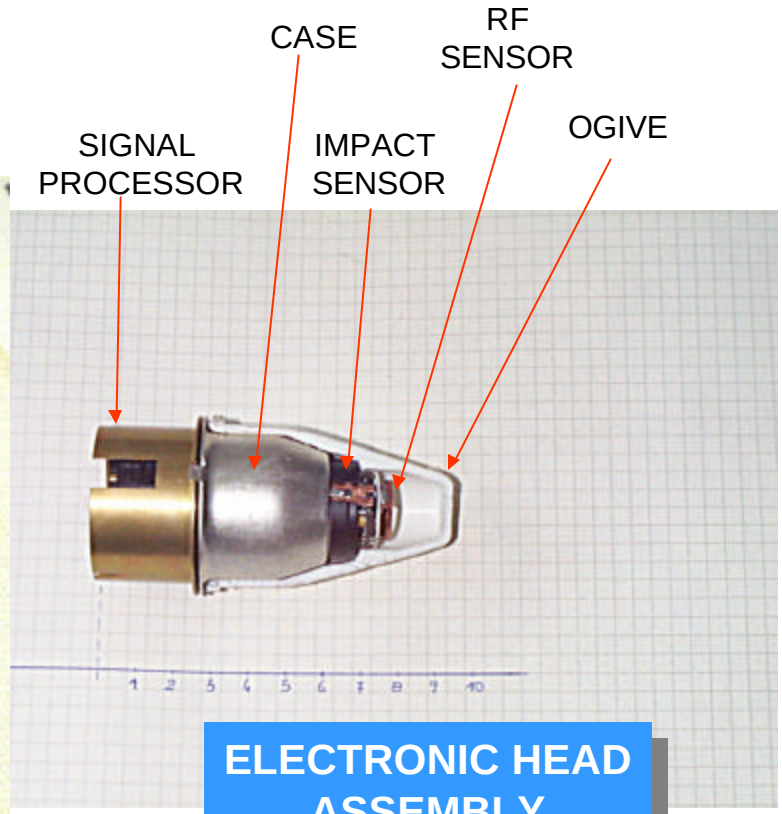
FUZE TECHNICAL DESCRIPTION

ELECTRONIC HEAD BREAKDOWN





ELECTRONIC HEAD ASSEMBLY

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TELEMETRY PROJECTILE FOR IN FLIGHT TEST

USED DURING FUZE DEVELOPMENT

FUZE UNDER TEST

TELEMETRY EQUIPMENT

- **2 A.C. CHANNELS FOR SENSORS SIGNALS (WIDEBAND)**
- **2 D. C. CHANNELS FOR POWER SUPPLY CHECK**
- **1 TRIGGER CHANNEL FOR DETONATION CHECK**

TELEMETRY ANTENNA

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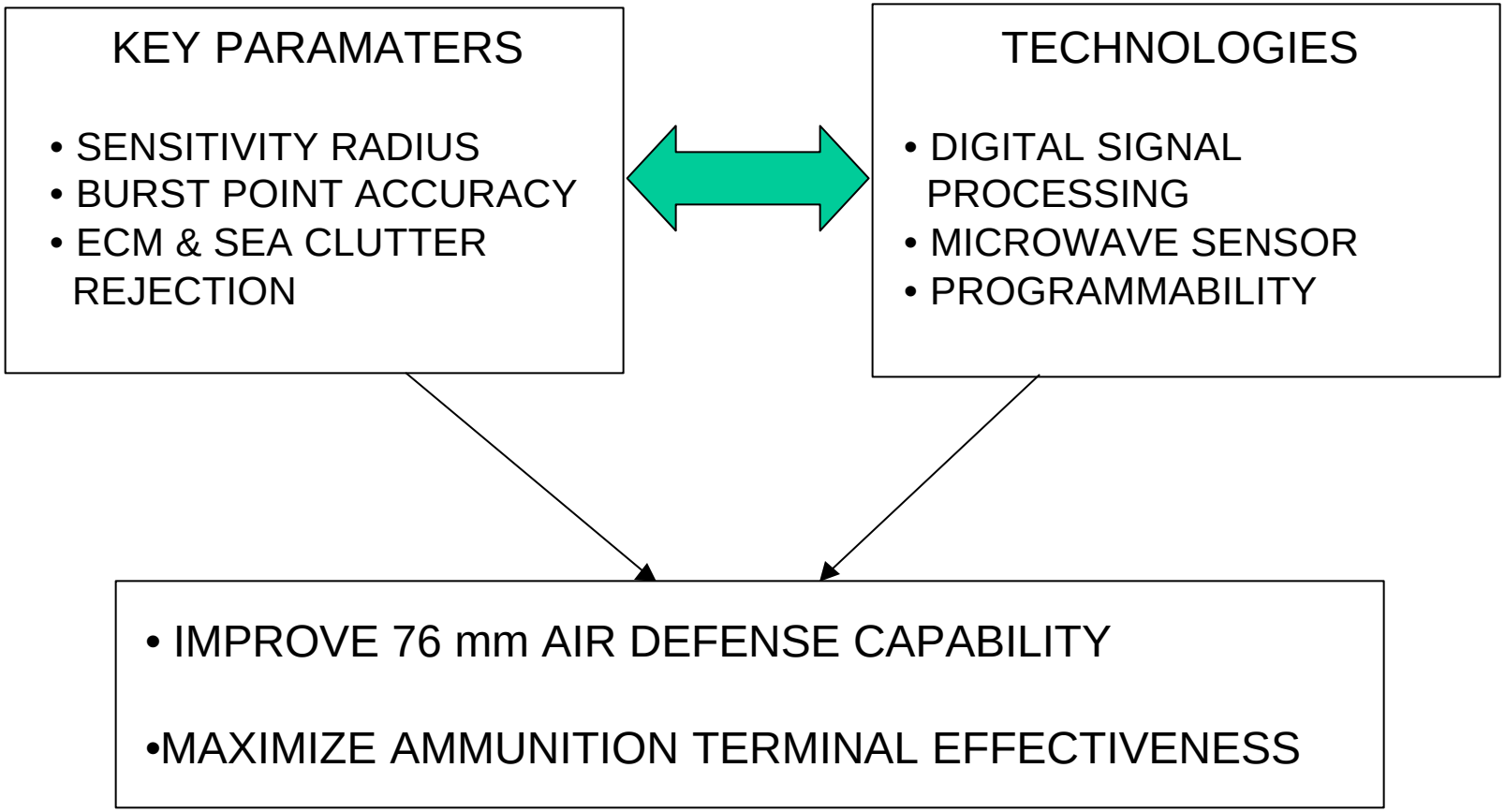
WHY A NEW FUZE



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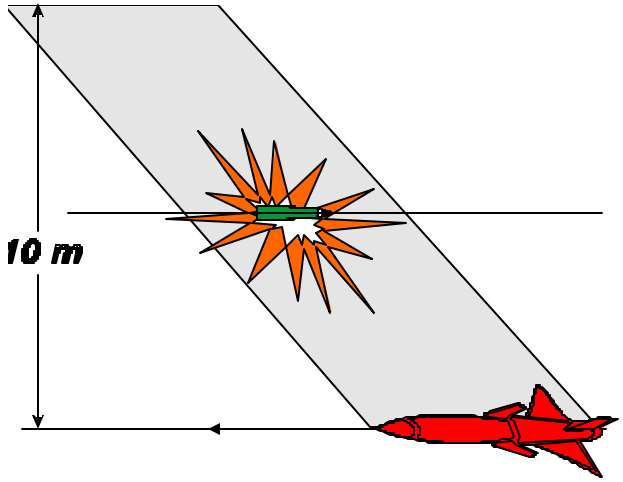
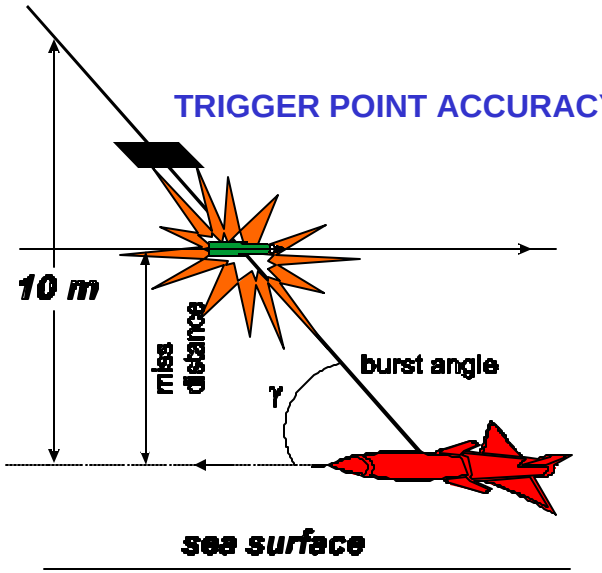
CHARACTERISTICS OF THE NEW MICROWAVE FUZE

USEFUL BURST ZONE
FOR AMMUNITION TERMINAL EFFECTIVENESS



TRIGGER POINT ACCURACY (1 m)



- **BURST POINT OPTIMIZATION ACCOUNTING FOR MISS DISTANCE AND RELATIVE INTERCEPTION SPEED**
- **INSENSITIVE TO SEA CLUTTER**
- **ECM PROTECTION**

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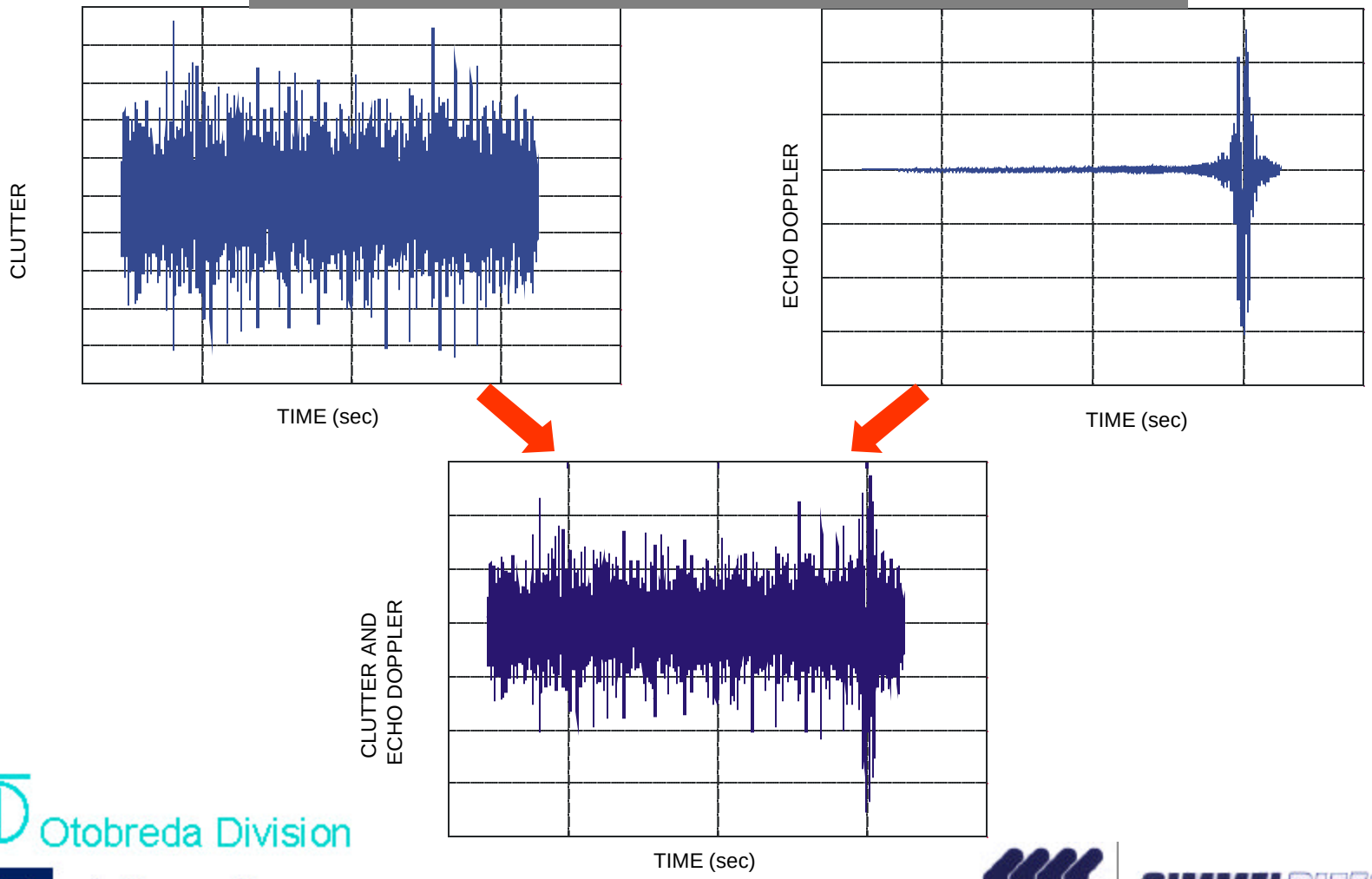
HIGH SENSITIVITY RADIUS

ACHIEVED BY

- LOW NOISE SENSOR
- HIGH COMPUTATION CAPABILITY DIGITAL SIGNAL PROCESSOR
- FFT AND PATTERN MATCHING ALGORITHMS



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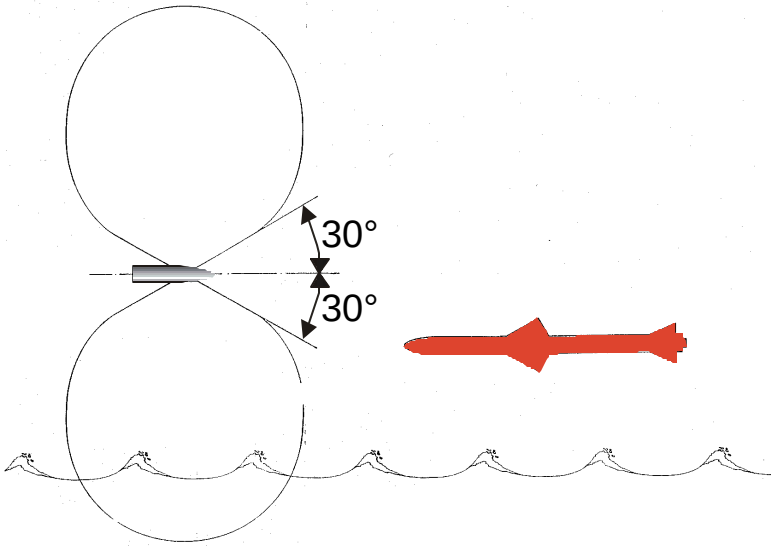
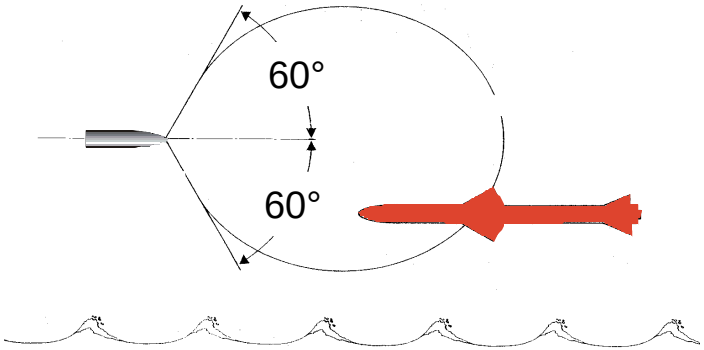
REJECTION OF SEA CLUTTER NOISE AND IMPROVEMENT TO TARGET DETECTION RANGE

BODY ANTENNA FUZE



NEW MICROWAVE FUZE



- INCREASE TARGET DETECTION RANGE
- REDUCE CLUTTER NOISE

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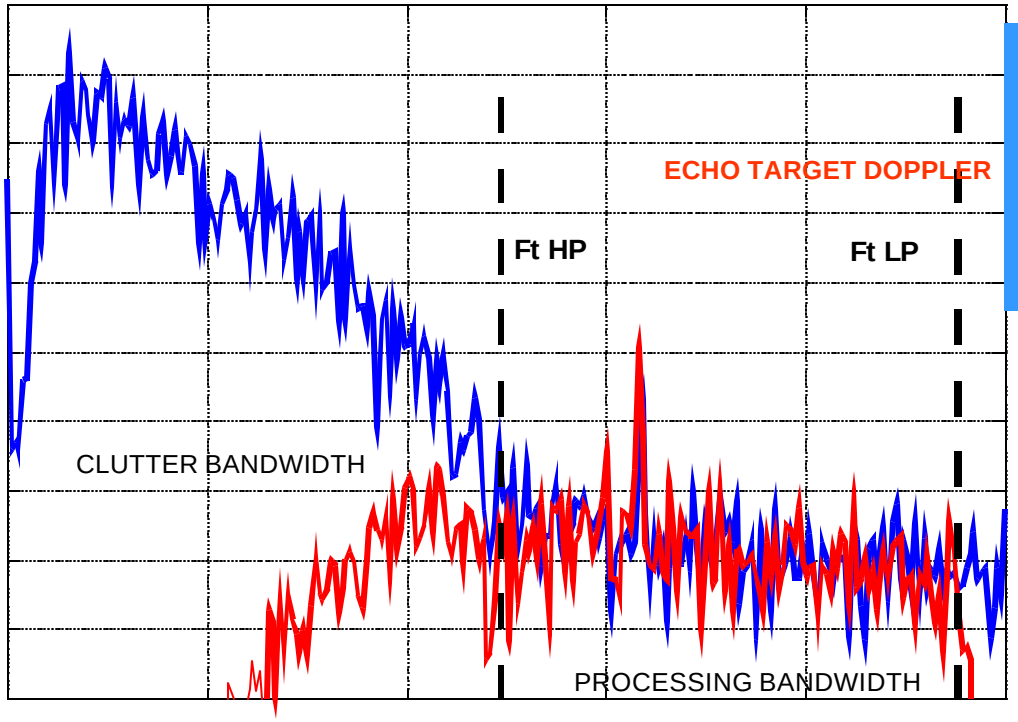
REJECTION OF SEA CLUTTER NOISE

ACHIEVED BY

- OPERATING NARROW BANDWIDTH ANALYSIS TO SEPARATE TARGET SIGNAL FROM CLUTTER NOISE
- INCREASING FUZE RF FREQUENCY TO INCREASE THE TARGET/CLUTTER SEPARATION



SPECTRUM OF SIGNAL (CLUTTER AND ECHO DOPPLER) RECORDED ABOUT 90 m BEFORE TARGET INTERCEPT

SIGNAL AFTER PROCESSING

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LOW SENSITIVITY TO EM ENVIROMENT

ACHIEVED BY

- **AN ELECTRONIC SETTER MOUNTED ON THE GUN WHICH ENABLES THE FUZE PROXIMITY MODE ONLY IN VICINITY OF TARGET**

- **USING NARROW BANDWITH SENSOR, ROBUST DIGITAL SIGNAL PROCESSING, ADVANCED SW LOGICS**

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PERFORMANCES IN PRIMARY ROLE

Primary Role	**: ANTIMISSILE**
Radial Sensitivity	**: > 10 m**
Action Probability	**: > 95%**
Level on sea	**: down to 2 m**

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IMPROVEMENTS TO THE "76/62 GUN BASED" SYSTEM

COMPARISON BETWEEN NEW MICROWAVE FUZE AND BODY ANTENNA FUZES (SEA SKIMMING MISSILE)

	MICROWAVE	BODY ANTENNA
RADIAL SENSITIVITY	> 10 m	3 m
TRIGGERING ACCURACY	1 m	2 m
DETONATION POINT OPTIMIZATION	ACCURATE (1)	COARSE
SEA CLUTTER REJECTION	VERY HIGH	MEDIUM
ECM PROTECTION	VERY HIGH	LIMITED

(1) Function of relative speed and miss distance

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FIRING TEST AGAINST LOW ALTITUDE TARGET

TEST LOCATION:
BALIPEDIO
"COTTRAU"

LA SPEZIA
15 JUNE 2000

8 ROUNDS FIRED WITH MISS DISTANCES BETWEEN 3 AND 6 m

MOVIE SHOWING 8 FIRINGS

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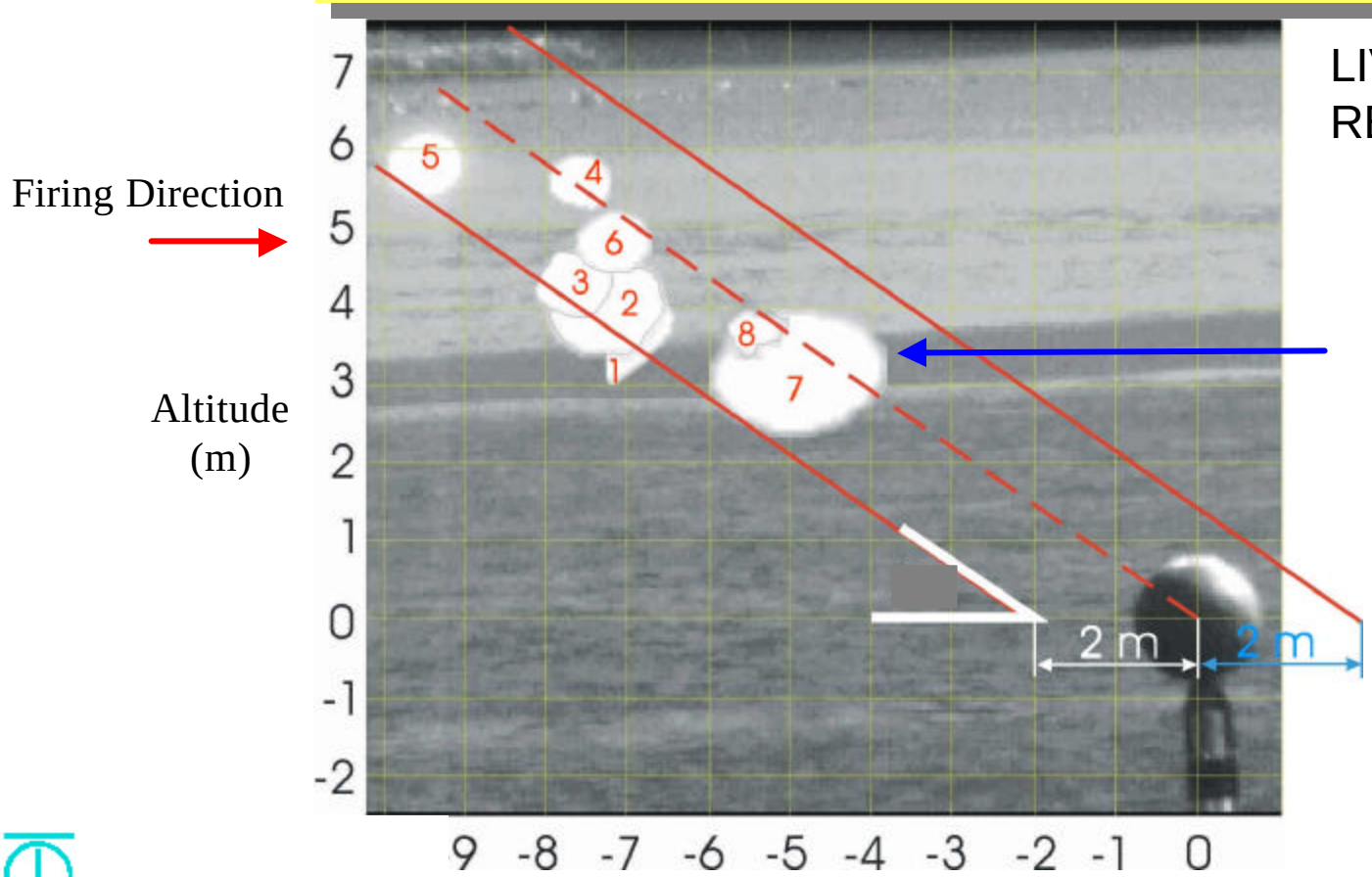
ACCURACY OF BURST POINT

ACHIEVED BY

- HIGH SPEED COMPUTATION FOR SIGNAL FREQUENCY ANALYSIS
- TRIGGER DECISION MADE BY ADVANCED SIGNAL PROCESSING INSTEAD OF TIME/AMPLITUDE ANALOG PROCESSING

LIVE TEST RECORDS



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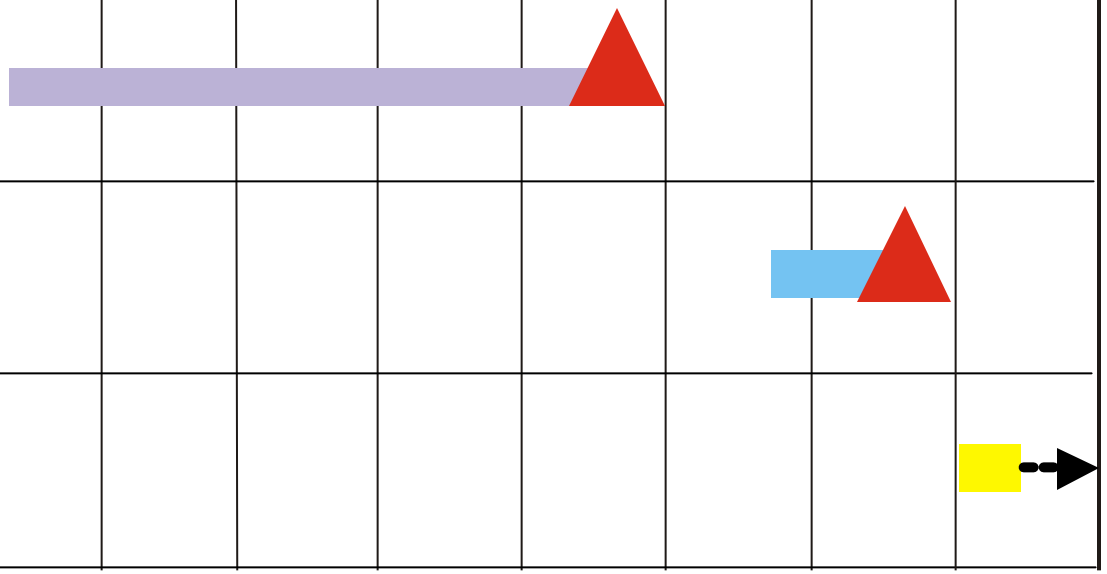
DEVELOPMENT PROGRAM AND INDUSTRIALIZATION

Nr.	PHASE	96-97	1998	1999	2000	2001	2002	2003	2004
1	DEVELOPMENT								
2	INDUSTRIALIZATION AND QUALIFICATION								
3	EARLY DELIVERIES								



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